

Congratulations! You've have purchased a highly effective tool for teaching middle school mathematics. Before you begin, get familiar with the content, technical considerations, and hands-on lessons you can incorporate with this guide.



Curriculum Planning

1. Read the content guide to get a good sense of what to expect.
2. The hands-on lessons included in this guide are highly effective. You can plan them for days you do not go to the computer lab.
3. Have all of your students entered in the roster prior to class, and print this list.
4. Before you arrive at the computer lab, ensure your school has released any "blocks" from the site if this is common.
5. Take advantage of the Ko's Journey download technology and have the same students log-in with the same computer and same browser (Internet Explorer, Safari, Firefox, Chrome) each time.
6. Take 5 minutes to let students know what they are getting into. Ko's Journey is not a traditional video game with explosions!

Technical Considerations

1. Ko's Journey takes about **5 minutes** to load. Ko's Journey is full of data in the form of audio and images and takes about 5 minutes to load each time you log-in.
2. Tell your students not surf the web or it will slow down the process, and offer that they can quietly talk until the application loads. If it takes longer than 7 minutes, call us.
3. Have your students log-on each time to the **same computers** using the **same browser** if you can. While it's entirely o.k. to access Ko's Journey from different computers, using the same computer and same browser can speed up the downloading process. If the student logs-on at home, it may take longer for the application to load. There is no problem with this, it just means longer waiting times. Let them know.

TECHNICAL SUPPORT: Call us at 801.657.1035 for technical support or email support@kosjourney.com

Pre-Game Set-Up


Computer
30 Minutes

+


Optional Hands-On
20 Minutes

Don't underestimate the value of this section. This pre-game set-up sets the learning environment for this entire curriculum. First, take time to familiarize yourself with the administrative page and set-up your student roster. You can go to the main login at www.kosjourney.com and enter your login and password.

On the administrative page, you will be able to add, edit and delete students. Simply, click on "Add a Student" and first and last name then click on "Save Changes." The program will automatically assign an individualized login and password for each student. Here you will be able to see the progress and test scores for the lessons. For each student, you can edit by clicking on the yellow pencil or delete by clicking on the red circle with the minus sign.

Take a moment to review the "Student Admin" text box that provides directions for "Game Loading" and "Save Game."

Deep Learning: *"Thought flows in terms of stories – stories about events, stories about people, and stories about intentions and achievements. The best teachers are the best storytellers. We learn in the form of stories."* – Frank Smith, Author of Glass Wall: Why Mathematics Can Seem Difficult

Lesson Idea!

Create curiosity to set the foundation of the story of Ko and math. What was math like before calculators? How was math used in ancient wilderness? Show them a picture of the Lebombo bone, the oldest known mathematical object. What were these people measuring? What do the tally marks represent for them? Why was a tally stick meaningful to the people? Ask your student(s) if they know why it is easier to count in 10's than 7's. Have them research and draw a picture of math in a historical setting of their choice, such as the Inca, Maya or Egyptians, and one interesting fact about their math practices.



Hint: If students forget their login and password, you can access them on your administrative page. If you forget your password, go to the main login and click on "Forgot Password?"

Note: The administrative page also includes your account and billing information.

Lesson 1: Pre-Test


Computer
30 Minutes

+


Optional Hands-On
20 Minutes

When your student(s) first login to Ko's Journey, they will be prompted to take a pre-test. The pre-test is 20 questions and takes about 25-30 minutes to complete. Encourage them not to work with neighbors and to not worry about knowing the correct answers. This is an assessment of where they are today.

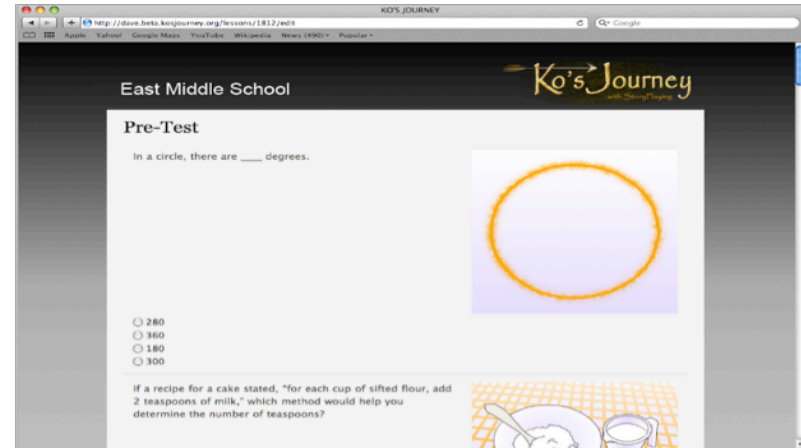
Have your student(s) read and reflect on the "Did you know..." section on their landing page to prepare them for the lesson below.

The pre-tests are automatically scored, instantly updated on your administrative page. You can click on each student's pre-test to determine what questions they answered correctly or incorrectly, so you can assess where your student(s) are having trouble.

Deep Learning: *Expert mathematicians spend a long time thinking about how to solve a problem, a little bit of time solving it, and a long time "looking back" to see if the answer makes sense.*

Lesson Idea!

Talk with your student(s) about practicing math like an expert mathematician. Give them a multiple-choice test in paper and pencil version with 10 questions. (Don't use a computer test for this!) Tell them to place their pencils down and to think about how they are going to solve one problem and time them for 1 minute, but don't allow them to select an answer. Then, give them 45 seconds to solve the problem using pencil and paper. Then, tell them to place their pencils on the desk again, and give them 1 minute to see if their answer makes sense by "looking back".



Lessons & Tests for jen			Students >>
Name	Score	Status	
Pre-Test	19/20	Complete	
Compass		Assigned	
Medicine Poultrice		Assigned	
Luna		Assigned	
Bolsa		Assigned	
Mid-Journey Practice Test		Assigned	
Crystal Oasis		Assigned	
Secret Circle		Assigned	
Mountain Climb		Assigned	
Crystal Cave			
Post-Test			

Hint: On your administrator's page, click on an individual's student's pre-test to see the questions they answered correctly.

Lesson 2: Compass & Travel


Computer
50 Minutes

+


Optional Hands-On
100 Minutes

Today your students login and launch the game. They will first be immersed into a story-based movie (about 15 minutes long) that teaches about the origin of degrees as best we understand from math history.

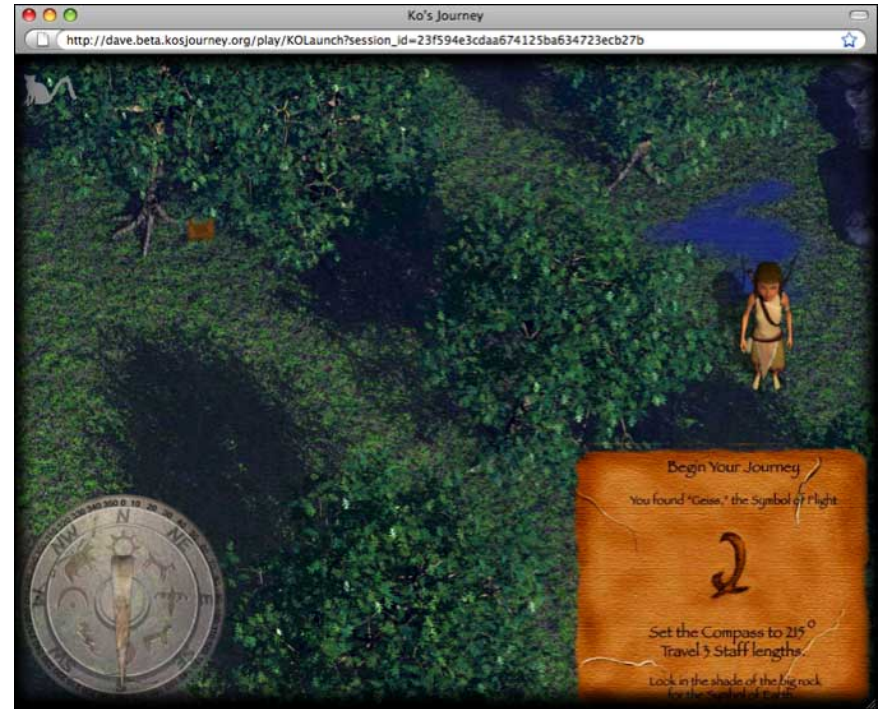
The game moves into the task of using the compass. This lesson teaches degrees of a circle, and while simple, gives your students a very deep understanding of what a degree means.

Upon first launch of the game, we recommend letting students help each other, and allowing them continuous play for up to 50 minutes.

Deep Learning: *“Learning is not just learning new things. Learning is also learning concepts in a deeper, more meaningful way.”* – Art Combs, Author of *The Schools We Need*

Lesson Idea!

Reinforce the compass lesson with an incredibly fun activity- a treasure hunt. Borrow compasses from the science teacher or local high school (magnetic compasses) and teach how they work. Then, write a clue such as those you see in Ko's Journey. “Walk 10 steps bearing 134 degrees.” Then set the compass to that degree, walk the steps and place the next clue. Show your student how to do this, put them in teams of two, and have them create a treasure hunt with some hand-made art for a reward at the end. Once a team has placed the clues, pair that team with another team who have finished creating their treasure hunt so they follow each other's clues. Have students write up what they learned about degrees.



Math Content:

- ✓ Simple Multiplication
- ✓ Degrees of a Circle

Hint: The application is designed to be a little forgiving during the compass task if student enters a “wrong” but close number, just as in real life. You may want to let students help each other so you have time to help certain students with the bigger questions.

Lesson 2: Compass & Travel (continued)

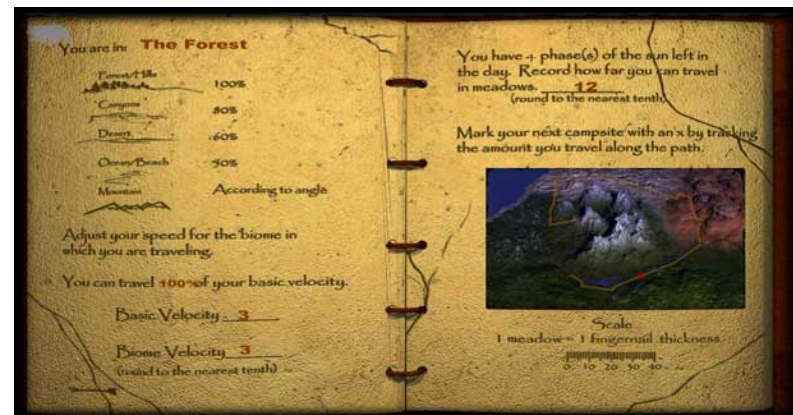
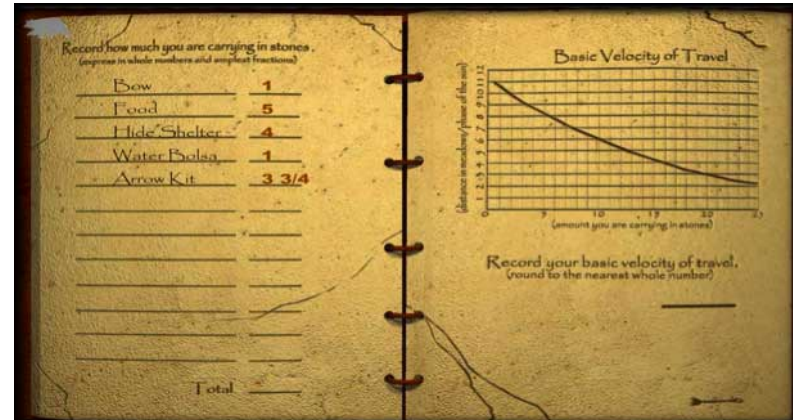
Your students will likely progress through the traveling process on the first day they launch the game. After gathering, (which is built like a simple maze), students add a set of numbers that represent how much they are carrying, determine how fast they can travel using a graph in the guidebook, see how long they have to travel and multiply the time by the speed to arrive at distance, and then apply the number to scale. Your students will understand this sequence after a couple of times of using it.

Always have students “finish” a travel sequence because this is where the automatic game save function happens! Let your students know that a good time to close their game is right after a travel sequence. The travel section becomes more and more challenging!!

Deep Learning: *Try to find math games where math makes conceptual sense with the story-line. Use sparingly games such as those that blow up asteroids through addition, or move a player along a baseball diamond, as they may be sending the message that math is conceptually disconnected from purpose, creating a lack of trust for the subject.*

Lesson Idea!

Improve students' comprehension of graphs by having them create their own from their own original surveys. Start by cutting out graphs from newspapers and magazines as examples. Ask them what the "story" of each graph is. Then, help them build a simple, but real survey—perhaps a comparison of boys to girls who rate their feelings of math on a scale of 1 to 10. Students should create their own questions and graphs and make a quick presentation to class. Try to work with your students to help them develop questions they care about.



Math Content:

- ✓ **Adding Fractions** (includes non-common denominators)
- ✓ **Reading a Graph**
- ✓ **Determining Distance** (variables of speed*time)
- ✓ **Applying to Scale**

Hints:

1. Always hit return to enter a number.
2. Click on the spot where the next campsite should be along the path.
3. When Ko “travels” the game is being saved.

Lesson 3: Arrow Balance & Travel


Computer
50 Minutes

+


Optional Hands-On
50 Minutes

The 2nd time students launch the Ko's Journey game, they will normally encounter the arrow balance task. There are 3 different arrow lengths, which must be matched with properly weighted points and fletch lengths. For each length of arrow (measured by finger-lengths) the point should be 100 sand-grains, so a 10 finger-length arrow needs a 1000 sand-grain point. The fletch length (in finger-nail thicknesses) should be $\frac{1}{5}$ of arrow point weight, so an arrow with a 1000-grain point should have 200 fingernail thicknesses of fletch. If this sounds confusing, it isn't. The application guides students through step by step.

Your student(s) will determine the pattern of setting up arrows with relative ease. If students provide the answer for each other in this section, don't make the mistake of thinking they are not learning. Students will be working with unique units of measure that stretch their thinking even when they "know" the answer. Students will continue traveling and likely arrive at the poultice problem.

Deep Learning: *The world contains an almost endless variety of units of measures from "feet" to "jules" to "megabits". Teach students to create their own units of measure to demystify the concept that a "unit" is magic, and/or scary to comprehend.*

Lesson Ideal

Have students create their own units of measure. Start simple, by measuring distances in the classroom with sticks or body-lengths. Use the same distance (across the length of the classroom, or height of a wall) for all measurements. You can group students into pairs. Once they are done, have each pair of students share their measurements, with the goal that they must convert 1 of "their" unit of measures to the equivalent of the others. Use decimals rounded to tenths.



Math Content:

- ✓ Number Relationship
- ✓ Division
- ✓ Units of Measure

Hint: During the arrow task, students place a point on arrow, which weighs 100 sand-grains for each length of the arrow. Students need to click and down on the cutting tool to adjust the length of fletch to $\frac{1}{5}$ of arrow point weight.

Lesson 4: Medicine Poultice & Travel



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In this lesson, Ko encounters a wounded wolf and must determine how to make a poultice using ratios to save the pup. This is the first complex math problem. The guidebook provides a comprehensive explanation and your students can click on “See Guidebook” at any time to review.

For your quick key:

1. Enter the weight of the animal and you will be guided to the correct weight.
2. Multiply the Animal Weight by 10 for the number of sand-grains of poultice.
3. Multiply the total poultice weight by .2 to find the weight of the water.
4. Subtract the water weight from the total weight to find “medicinal plant” weight. This is not entered.
5. Divide “medicinal plant” weight by the number by 12 to find the base multiplier. This is not entered.
6. Multiply by each plant ratio number by this multiplier.

Your student(s) may help each other, but here’s a clue for the teacher: the wolf is a different weight each time, which changes the weight of each medicinal plant needed!

Deep Learning: A study by New Mexico State University found that teachers often teach the “math” of concepts students don’t yet understand. In response, the NMSU created a video series to teach concepts through very funny skits. You can check one out in the lesson idea below.

Lesson Idea!

Direct your student(s) to www.mathsnacks.com and launch the video “Bad Date.” Break students into groups of 3 and have them create and share their own skits (like they saw in the video) on the concept of ratios or other threads of math.



Math Content:

- ✓ Estimation
- ✓ Percentage of a Number
- ✓ Complex Ratios
- ✓ Determining a Variable

Hint: 1. You can always click on “See Guidebook” to go back “into” the guide for an explanation.
2. Don’t forget that 20% of the poultice is water, so the medicinal plants make up the other 80% of the poultice weight, not 100%!

Lesson 5: Luna & Travel


Computer
50 Minutes

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Optional Hands-On
25 Minutes

Your student(s) will have a longer travel journey through the forest biome, with no more “events” until the canyons. This repetition will greatly help them later recall concepts on tests.

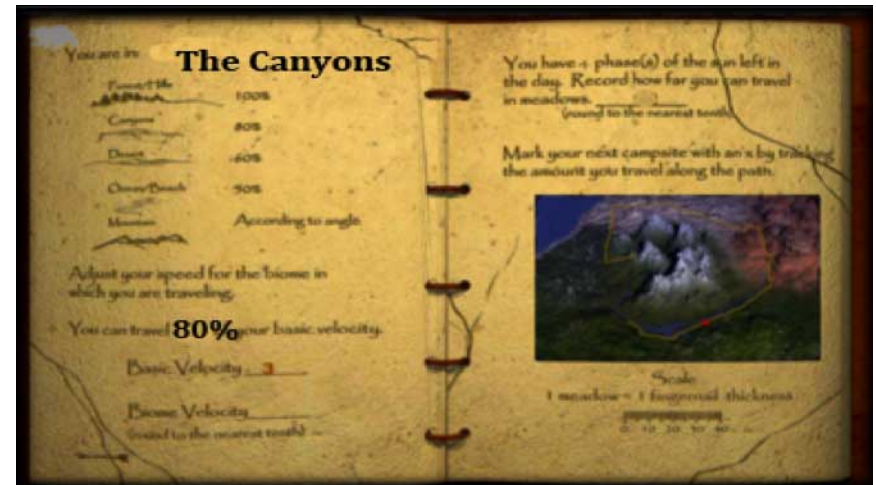
Shortly after arriving the Canyons, notice that the percentage of their “basic velocity” changes from 100% percent to 80%. Many students will have questions at this point. If many students are arriving at this point at the same time, it may be worthwhile holding a class to teach how to find a percentage of a number. Round here to tenths of meadows/phase of the sun.

When they arrive at the Luna “event”, most students will begin right away “placing” rocks. Don’t drag them. Just click on the appropriate coordinate locations and the rocks will “pop” into place. The last step is using a line equation to determine where the North Star is.

Deep Learning: *Story is so important to learning math that students can recall math in a problem meaningful to them years later. It actually helps build the neural pathways in the brain to access how to solve problems.*

Lesson Ideal

Have students plot their own points that form a picture. Then, have them write down the coordinates and instructions on another sheet of paper. Have them trade coordinates with another student and connect the coordinate points as instructed.



Math Content:

- ✓ Cartesian Coordinates
- ✓ Line Equations
- ✓ Percentage of a Number
- ✓ Rounding

Hint: Don't drag the rocks, just click on the appropriate location and they will “fall” into place.

Lesson 6: Bolsa & Travel


Computer
50 Minutes

+


Optional Hands-On
50 Minutes

By the time your student(s) have arrived at the point in the game where they are to cross the “grand desert” they will be well versed in the structure of traveling. This will help for the Bolsa problem, a multi-step volume problem. The key to solving the problem is determining how many droplets of water the travelers need for the crossing, and cutting the height of the bolsa to the proper length to create just the right size water bolsa.

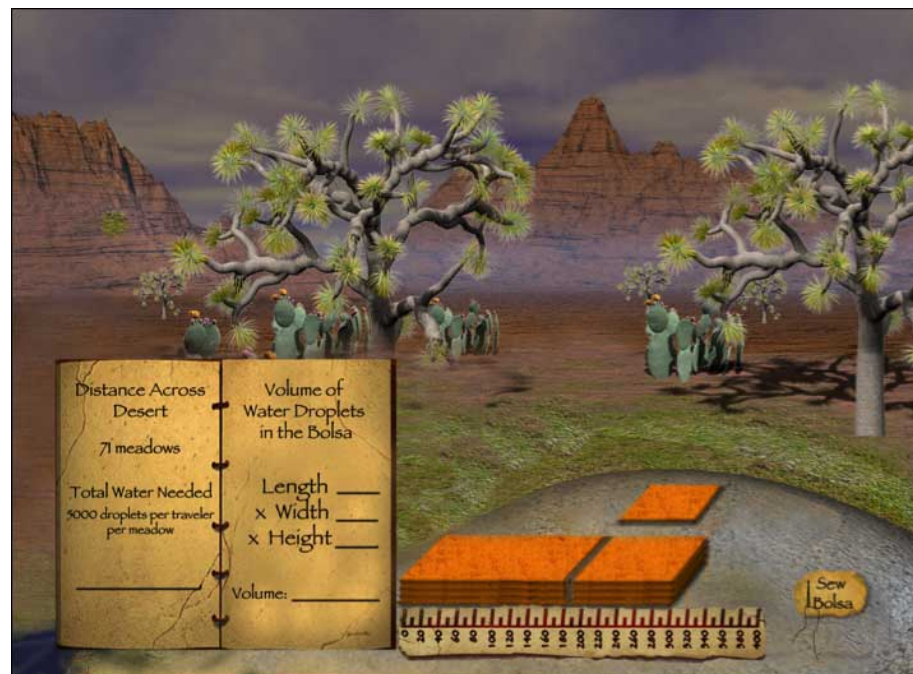
Solve by multiplying the number of meadows by 5,000 (the # of droplets per meadow) and then multiply by 2 (because Meka is counted as one of the travelers). Divide this by 2500 (the area of the base in “fingernails”), and set the length to this number. A couple of clicks later and you’ll have bolsa and be off traveling again.

It’s important to not just automatically tell the students how to solve this problem. They will naturally set the length higher or lower than it should be and calculate the volume. After a number of attempts, they will likely seek a different approach, a good time for teacher support.

Deep Learning: *Most students don’t know what the little “3” means after a unit of measure in a volume calculation. Back up and teach that area is two dimensions (hence the little “2”) and the little “3” means 3D!*

Lesson Ideal

The 50 to 5000% More Advertisement! Start with 5 actual household items such as a soda can, candy box or laundry detergent and have students measure these items and calculate volume in teams of two. Their task is to pick one, increase its volume by 50% up to 5000% and create an advertisement poster based on the new dimensions. Have them act out a commercial too!



Math Content:

- ✓ Large number multiplication
- ✓ Volume Computation
- ✓ Multi-step equations
- ✓ Determining a Variable

Hint: During the application, students are trying to match the volume needed with the volume of the bolsa. When cutting the sides, click on the cutting tool.

Lesson 7: Mid-Journey Practice Test



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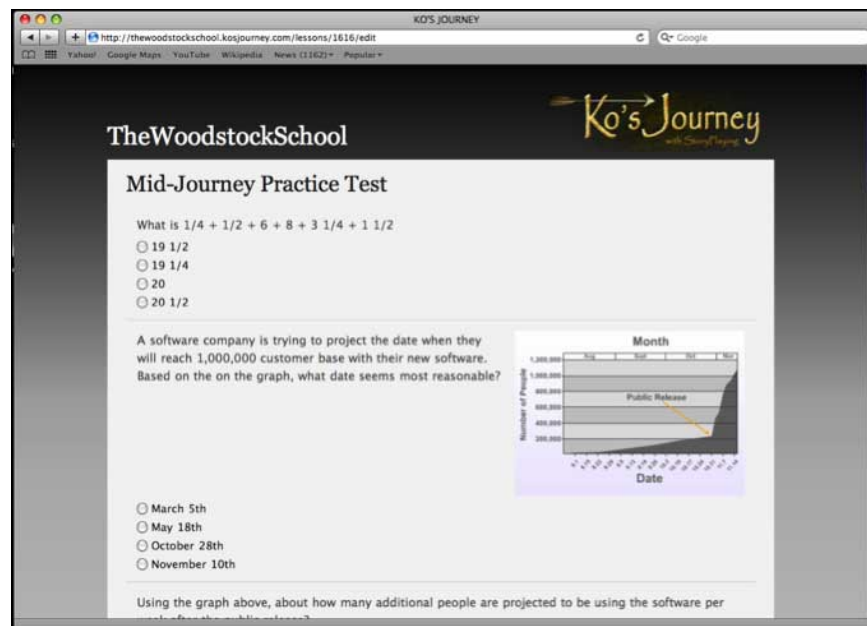
When your students have arrived to the point where the Mid-Journey practice test appears on their landing pages, it can be good idea to ask them to pause on their journey (after taking the test). Have students who are ahead help others on a one on one basis. This serves two purposes. Obviously, it can help those who need support move along more quickly. Additionally, it reinforces a classroom culture where students are teaching other students.

Once all students have completed the practice test, it's an important time for reflection. Students who practiced the type of reflection described in the lesson idea below performed better than their peers who did not on state tests.

Deep Learning: *The largest FAA study ever conducted on flight training had a major finding. The pilots that learned MOST SLOWLY made the fewest mistakes later as professional pilots. We bet some math students would like to hear that one.*



Have students write down everything they have learned to date through Ko's Journey. Ask them to pick out 3 very specific types of math and create one unique math question for each of the 3 threads they are describing, answer them, and write a quick narrative about how the math works. Have students finish with an essay about the meaning math holds for them in their current lives. In a future class, have students share these essays in round table conversations. These "social" approaches to class allow students to more readily identify with having aptitude in math even when they talk about their difficulties with the subject.



Math Content:

- ✓ Fractions & graph reading
- ✓ Percentage of a number
- ✓ Complex ratios and multi-step problems
- ✓ Determining variables

Hint: In the application, you not only can see the score of each test, but the questions a student missed. Spending just a few minutes looking through these questions can lead to understanding patterns where students need support.

Lesson 8: Crystal Oasis


Computer
50 Minutes

+


Optional Hands-On
50 Minutes

When students begin traveling in the desert, they need to take a percentage of a number every time they travel and round to the nearest tenth. This repetitive calculation that occurs during each travel sequence bolsters student confidence in this crucial areas of middle school math.

During the Crystal Oasis, students choose a crystal, note the angle of incoming light, the angle of exiting light, and the angle between the two. The student selects a crystal, records these angles, and then selects another crystal until all of them have been recorded. At this point, a final crystal is chosen.

Students will gain a strong sense of what an angle means from this application, and there is the added benefit that each crystal weighs $\frac{1}{3}$ of stone and fractions with non-common denominators are being summed during each section of travel.

Deep Learning: *Most teachers know the story, but it's worth reminding. During the famous Pygmalion Study teachers were told that one group of students were "brighter" than another group. Of course, there was no real distinction between the two groups. In the end, the arbitrarily created "bright" group excelled. Expectations are not rules for students. They are the deep beliefs of teachers about their students' abilities.*

Lesson Ideal

By this point in the game, you can really improve student learning with a concept map. Concept maps are easy and an exceptional tool to reinforce learning. Start with a word at the center a map, such as "Math" Let students take the concepts into the emotions, meaning, specific learning, and questions they might have. Debrief in journal form.



Math Content:

- ✓ Estimating angles
- ✓ Subtraction
- ✓ Fractions with non-common denominators

Hint: Most students will find the crystal oasis by itself relatively simple as an application. The challenge comes after when they need to "carry" the crystal, which weighs $\frac{1}{3}$ stone.

Lesson 9: The Secret Circle



Computer
50 Minutes

+



Optional Hands-On
50 Minutes

As Ko and Meka are getting closer to the end of their journey, they come upon 3 circles left by their elders in the past. These circles are part of the key to returning home. The circle that the student chooses has a radius, which is the height of the staff upon which the crystal must be placed to “open the gateway.”

The application itself is very simple, and students will not have any confusion moving through the game. Many students however, may not know how to determine the radius from the circumference. Taking the time from a lesson to deepen this learning can really help.

To determine each radius, students must divide the number of steps by Pi (3.14) to determine the diameter and divide this by 2 for the radius.

Deep Learning: *In an overview of all the studies on girls and math, the biggest finding was that “students who view their cognitive abilities as fixed from birth or unchangeable are more likely to experience decreased confidence and performance when faced with difficulties or setbacks regardless of gender.” Students of teachers who explicitly teach that cognitive ability is “expandable” gained confidence- and aptitude- in math.*

Lesson Idea!

Students often need to see the interrelating parts of a circle in many different ways to understand exactly how they are related. Start with a lesson where students measure the diameter of a can with a string and determine how many diameters there are in the circumference. Try different circles and different ways of teaching the circle throughout the lesson. End with students sitting in a circle and ask them to spend time talking about their experience with math, with the goal to spend an almost equal time of each person speaking, in essence reflecting a circle. Document what you learned from the dialogue as part of “short-cycle” assessment to help you with planning the next few classes.



Math Content:

- ✓ Diameter, radius and circumference
- ✓ Determining an unknown variable
- ✓ Relationship of parts of a circle

Hint: The radius is the length of the staff Ko needs to choose later in the cave upon which she must place a crystal.

Lesson 10: The Great Mountain Climb



Computer
50 Minutes

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Optional Hands-On
50 Minutes

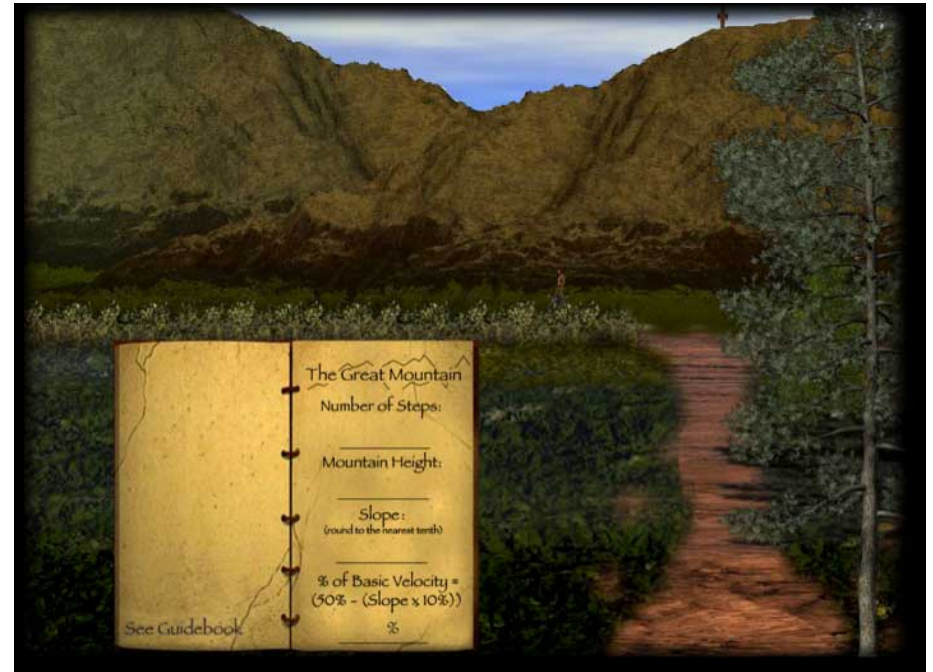
The Mountain Climb begins with a guidebook read that Ko and Meka are on the last leg of their travels. To negotiate the mountain climb, students must have a basic understanding of slope, and order of operations. In a relatively straightforward manner, Ko and Meka count the steps from under the top of the mountain to know the horizontal length of the path they must take to the top. The vertical height is given from Elders in the guidebook.

Determining the slope is as simple as dividing rise by run, and rounding to the nearest tenth. This must then be entered into an equation to determine the velocity Ko can travel. Most students enjoy the clear understanding and explanation of slope and gain a solid comprehension of the topic from climb.

Deep Learning: *As we know a student's performance on a standardized test is directly related to his or her identification with being "good" with math. Working with these fundamental feelings that students hold about the subject can be seem overwhelming. A simple change of language can help. When a student states "I am not good at math," by replying "you mean you **feel** you are not good at math," over time, the old, "I am..." is replaced with a more fluid, "I feel..." which can change to an "I think I'm a little better..." It really works and impacts test scores.*

Lesson Idea!

It's time to bring in your students' own story problems. By now, from your students' experience with Ko's Journey, these can grow to be fairly elaborate. Ask students to write out a story problem that includes hand-drawn pictures with a theme of their choice on whatever math concept you are teaching. Creating these artistic/thematic/story-based math problems will greatly deepen the concept they are studying.



Math Content:

- ✓ Determining slope
- ✓ Division
- ✓ Rounding
- ✓ Order of operations
- ✓ Using a basic algorithm

Hint: Don't forget to use the order of operations and round the number to the nearest tenth.

Lesson 11: The Crystal Cave


Computer
50 Minutes

+


Optional Hands-On
50 Minutes

The Crystal Cave is a culminating problem. The student encounters a multi-step problem where Ko is trying to place a crystal upon a staff of the correct height (matching the radius of the secret circle), which is placed on the correct etching on the cave floor for the light to come in at the correct angle to send 180 degree beam into the cave opening.

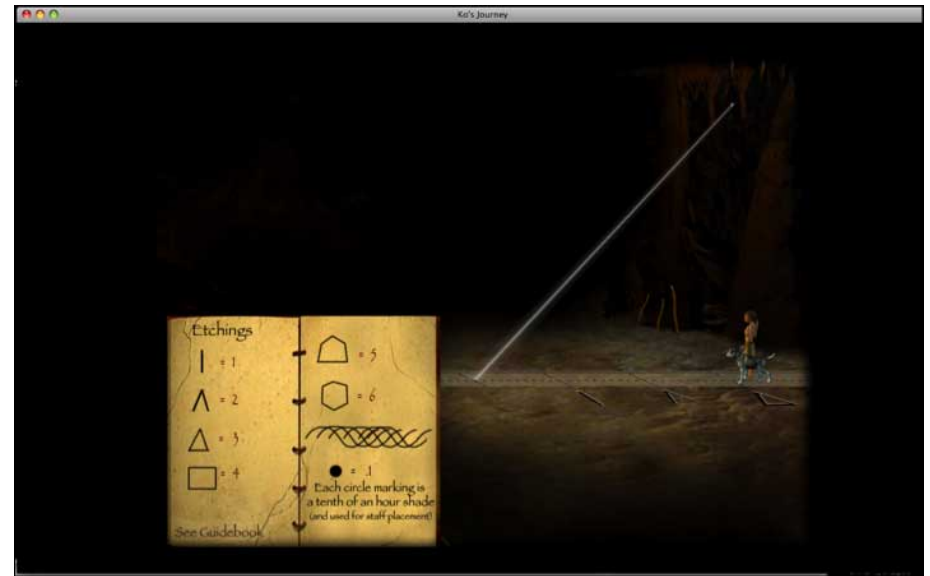
The math and physics of the problem are phenomenal. While still maintaining a middle-school level, this “Indiana-Jones” type problem matches very closely what would happen in real life. Using the specific crystal that Ko carried with her from the Oasis and the angle that crystal deflects light, Ko must first determine how time and sunlight angle are related.

Leaving this problem as final challenge for all to solve, teachers included, remember to round where it mentions to round, and remember to follow the order of operations for all basic algorithms.

Deep Learning: *Perceived learning barriers are challenging for students to overcome. The research on grades and scoring shows us that if those scores are tied to an evaluation during the learning process they can prevent the perceived barrier from being broken. Try to create some scoring that is not attached to the grading process.*

Lesson Ideal

Have groups of two replay the cave module once everyone has finished the game. Tell them to write a report on whether this could happen in real-life. “Does the math match up?” Share the reports at the end of class.



Math Content:

- ✓ **Supplementary angles**
- ✓ **Division**
- ✓ **Rounding**
- ✓ **Determining variables**
- ✓ **Problem organization**
- ✓ **Working with decimals and scale**
- ✓ **Order of operations**
- ✓ **Using a basic algorithms**
- ✓ **All basic functions**

Hint: On the very last step of the problem, click on the exact spot where the cave staff is to be placed, which is one of the time markers (points) on the cave floor.

The Post-Test


Computer
50 Minutes

+


Optional Hands-On
100 Minutes

Use the post-test as a true evaluation. Make this a “graded test” that counts for class. In split tests the post-test has approximately the same level of challenge as the pre-test so you will be able to see the level of growth with the students.

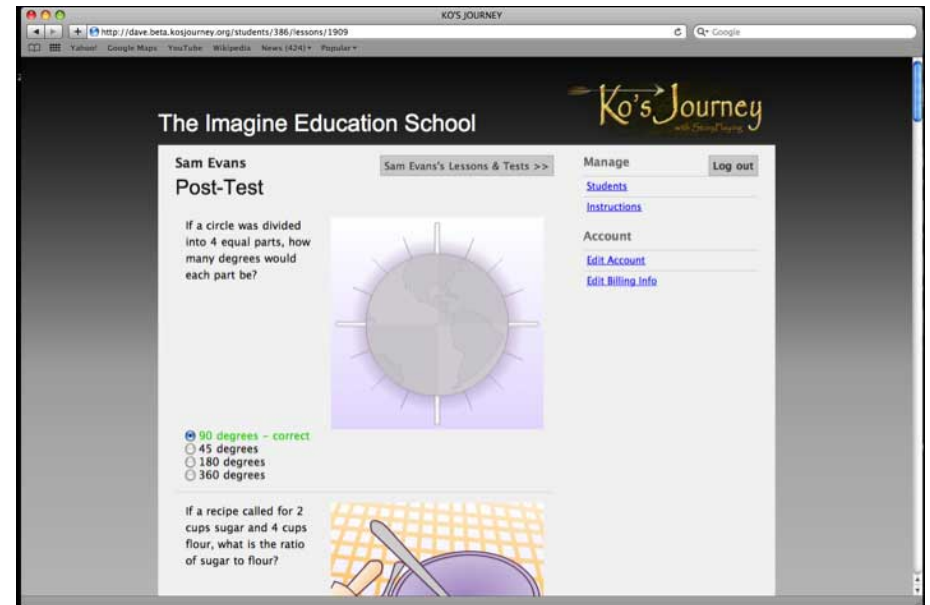
The day before, review the concepts in the game to date. Teachers often play through themselves to get a view of the post-test before administering it.

Deep Learning: *Perceived learning barriers are challenging for students to overcome. The research on grades and scoring shows us that if those scores are tied to an evaluation during the learning process they can prevent the perceived barrier from being broken. Try to create some scoring that is not attached to the grading process.*

Lesson Ideal

Have each student create a Ko's Journey poster of one problem they encountered in Ko's Journey. Have them 1) draw with colored pencils and include original artwork of the problem 2) include the math 3) write a description of that type of math 4) create a standardized type test question similar to the math in the game.

If each student covers a different part of the game with only mild overlap, the room will be filled with math posters to show off. Hold a “student-led” conference in the evening and have parents come in. Student-led is exactly that. It is not a parent/teacher conference. Let the students do the talking and let them show off their learning.



Math Content:

- ✓ **Supplementary angles**
- ✓ **Division**
- ✓ **Rounding**
- ✓ **Determining variables**
- ✓ **Problem organization**
- ✓ **Working with decimals and scale**
- ✓ **Order of operations**
- ✓ **Using a basic algorithms**
- ✓ **All basic functions**

Hint: Don't forget that you can see each problem a student answered correctly or incorrectly.

We also offer math consulting for schools and specialize in turning around programs where students are having difficulty with math. Please feel free to contact us:

Math Consultation for your School

The following consulting services are customized to fit the distinct needs of your organization:

- Conduct an analysis of current practices & present integrative teaching methods
- Help identify what technical tools & resources teachers & administrators have available
- Help teachers understand how their practices and assessment affect learning
- Work with students in developing peer learning and self-directed projects
- Facilitate playing rich, story based math games for teachers and students
- Follow-up with benchmark reviews & next steps including innovative programs

To inquire about math consultation for your school, contact:

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scott@imagineeducation.org

801-657-1035.